Sphagnum farming: lab and/or field experiments

The agricultural use of drained peatlands leads to huge emissions of greenhouse gases and nutrients. A land-use alternative that allows rewetting of drained peatland, while maintaining agricultural production is the cultivation of Sphagnum biomass as a renewable substitute for fossil peat in horticultural growing media (named Sphagnum farming). We have various topics for BSc and MSc internships that focusses on field and lab experiments. During your internship, you will sample (pore)water, plants and soils and study their interaction (e.g. drought stress indicators).

Start: from June/July 2021.

Established Sphagnum lawn. Note the ditches for irrigation. Picture: Ralph Temmink.

Field experiment

In a ~20-hectare experimental field site in northwest Germany, we have studied Sphagnum biomass yield and nutrient dynamics over the last years (Temmink *et al.* 2017, Vroom *et al.* 2020). Research has shown that the ditches – used to irrigate the site – are methane-emission hotspots. Moreover, common practise – the removal of the topsoil to enhance water infiltration to the Sphagnum mosses – results in carbon dioxide emissions from the removed soil. To reduce these emissions with different approaches, new large-scale experiments have been setup (see table below). You have the opportunity to perform research on one of these experiments with a focus on Sphagnum growth and nutrient dynamics. You will work in a team, and will be going on multi-day fieldwork campaigns in Germany (Hankhauser moor).

Experiment 1: hydrology	**Experiment 2: top-soil removal**
Low amount of ditches	No topsoil removal (only milling of the soil)
Infiltrate water using subsurface drains	10 cm topsoil removal
Infiltrate water using subsurface pressure drains	Control (30 cm topsoil removal)
Control (standard use of ditches)	*Crossed with Sphagnum-Typha planting*

Laboratory experiment

Sphagnum mosses typically grow well in nutrient poor and acidic environments. Water with a high alkalinity and cations negatively affect Sphagnum moss vitality (Koks *et al.* 2020). For the upscaling of Sphagnum farming, it is crucial to understand what levels of cations/alkalinity, which species can

tolerate. This is important because the quality of the irrigation water can differ strongly between areas and countries with concentrations that either stimulate growth or kills the mosses. In this laboratory experiment, you will test the effect of for instance bicarbonate HCO_3^- and cations on the vitality, growth of various Sphagnum species. Moreover, you are free to join fieldwork campaigns in Germany.

Contact

For more information, please e-mail Ralph Temmink (r.temmink@science.ru.nl) & Sannimari Käärmelahti (sannimari.kaarmelahti@gmail.com).

Literature for inspiration

Temmink *et al.* 2017. Sphagnum farming in a eutrophic world: The importance of optimal nutrient stoichiometry.

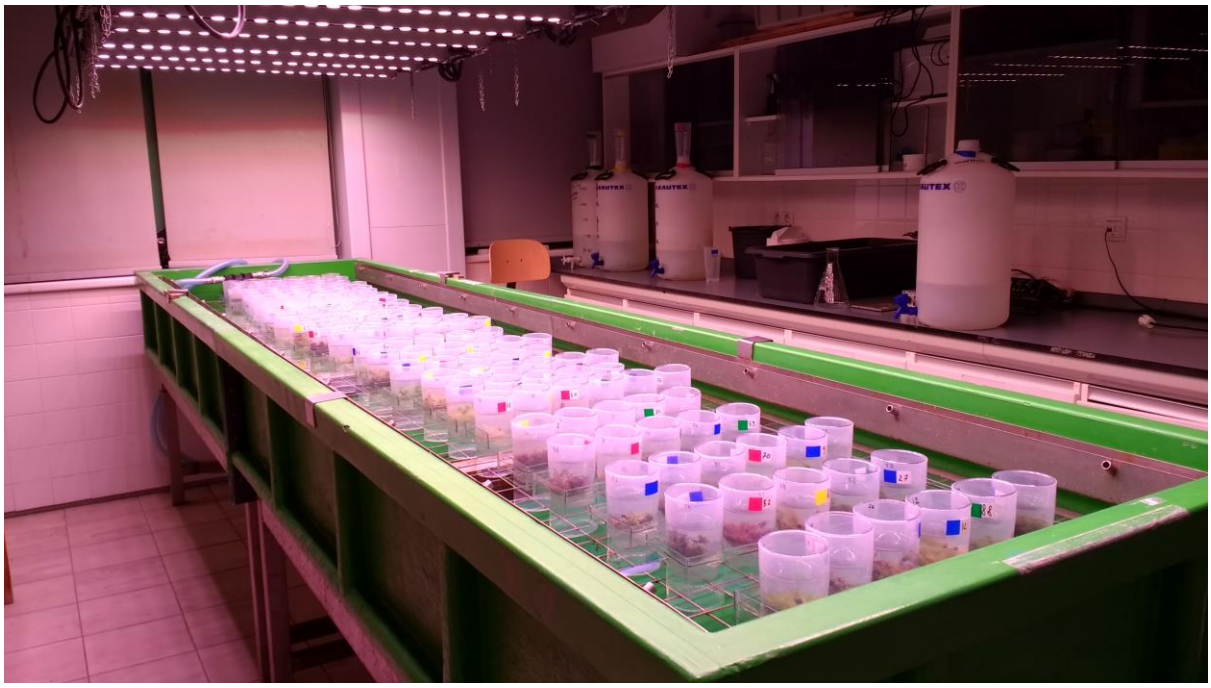
Vroom *et al.* 2020. Nutrient dynamics of Sphagnum farming on rewetted bog grassland in NW Germany

Koks *et al.* 2020. The effects of alkalinity and cations on the vitality of Sphagnum palustre L.

Pictures for inspiration

Experiment 1: hydrology. Experimental treatment with subsurface drains (no irrigation ditches). Sannimari for scale. You need snowshoes to walk on a Sphagnum lawn. The mosses have been recently planted, hence the colour. Picture: Ralph Temmink.

Experiment 2: topsoil removal. No topsoil has been removed in this treatment. Take note of the irrigation ditches. Picture: Ralph Temmink.



Former lab experiment with Sphagnum mosses grown under different environmental conditions. Picture: Adam Koks.